Acquisition of Moored Velocity Profiler Instruments in Support of Finescale Studies of the Littoral Ocean

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Long term goals

The long-range goal of our program is to develop instruments capable of repeated, autonomous vertical profiling of the ocean to sample variations in the water properties and currents.

Objectives

Research on ocean mixing carried out by J. Toole and R. Schmitt utilizing the free-fall High Resolution Profiler (Schmitt *et al.*, 1988) has returned samples of the ocean's temperature, salinity, and horizontal velocity fields and the associated dissipation rates of turbulent kinetic energy and temperature variance. While highly successful, this instrumentation is limited in the frequency at which it can be deployed, and by the finite duration of on-site research vessel support. To improve understanding of internal waves in the near-coastal ocean, we have been developing (with support from the ONR) a moored profiling instrument system (termed the Moored Velocity Profiler, MVP) able to sample oceanic finescale velocity, temperature and salinity variability autonomously. Grant N00014-97-1-0378 is funding the acquisition of two of the MVP instruments. With the new instruments, Drs. Polzin, Toole and Schmitt will study internal waves near the continental margins as contribution to the Littoral Internal Wave Initiative program.

Approach

Construction of the two MVP instruments is being guided by our experiences with a prototype instrument, as well as with similar instrument system designed to obtain hydrographic (T,S vs. P) time series autonomously (Frye *et al.*, 1996). The MVP utilizes the same basic drive system, mechanical layout, controller, CTD, and data logger as the hydrographic profiler. To it we are adding an acoustic travel-time current meter, and accelerometers, tilt sensors, and compass to

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measure instrument motions. The oceanographic instrumentation are obtained from Falmouth Scientific, Inc. (FSI): their MicroCTD, and a modified version of their 3D-Acoustic Current Meter. The engineering effort is being directed by Daniel Frye, head of the Institution's Advanced Engineering Laboratory, with scientific guidance from John Toole. Key contributors include Kenneth Doherty (mechanical engineering), Stephen Liberatore (software and electrical engineering) and Alan Hinton (electrical engineering). Technical support of the data analysis effort is provided by Ellyn Montgomery and Gwyneth Packard.

Work Completed

The basic system design and major component construction of the two MVP instruments has been completed. The two CTD instruments and current meters have been ordered. Final design and assembly is being held until we acquire additional experience with a prototype instrument. The prototype Moored Velocity Profiler was deployed for testing in January-February, and again on September 22. It will be recovered on November 4-5.

Results

The results of the MVP development effort are described in the companion report by J. Toole and R. Schmitt for grant N00014-95-1-1001.

Impacts/Applications

We believe the new Moored Velocity Profiler will prove an exciting and valuable addition to the present suite of oceanographic instruments. In particular, we are planning to use these instruments in a study of internal wave motions about the continental margin: a region characterized by energetic, high-frequency finescale motions.

Transitions

The two Moored Velocity Profilers to be constructed, plus those Moored Profilers already in hand will constitute a new Facility at the Woods Hole Oceanographic Institution. It is envisioned that scientific users will have access to these instruments just as they presently have to conventional current meters and CTD's. Moreover, the Moored Profiler technology has been licensed to a commercial company (McLane Research, Inc.) who will be offering these instruments for general sale. We have as well constructed instruments in-house for individual scientific colleagues (see below).

Related projects

An immediate goal of the Moored Velocity Profiler development program is in support of the Littoral Internal Wave Initiative (LIWI) program. We intend to deploy a close-spaced array of three profilers on the continental slope off Virginia to document the frequency-wavenumber characteristics of internal waves generated at / reflected from the bottom.
Our MVP development project is a companion effort to ongoing programs building experience

with and enhancing the Moored Profiler, a similar instrument to the MVP that carries only a CTD. The initial development effort of the Moored Profiler has been funded by the U.S. National Science Foundation (grant to J. Toole and D. Frye). Field tests of this instrument are being conducted offshore from Bermuda. A program to add real-time telemetry to the system is being supported by the National Oceanic and Atmospheric Administration through the University Consortium program (grant to J. Toole, D. Frye and R. Pickart). Lastly we have constructed two Moored Profiler units for colleagues at the Institute fur Meereskunde in Germany, and the U.K.'s Southampton Oceanographic Centre.

References

Schmitt, R.W., J.M. Toole, R.L. Koehler, E.C. Mellinger, and K.W. Doherty, The development of a fine- and microstructure profiler, J. Ocean Atmos. Techno., 5, 484-500, 1988.